



#8

SEQUENCE LISTING

<110> IVERSON, BRENT
GEORGIU, GEORGE
CHEN, GANG
OLSEN, MARK J.
DAUGHTERY, PATRICK S.

<120> DIRECTED EVOLUTION OF ENZYMES AND ANTIBODIES

<130> MXGN:005USC2

<140> 09/813,444

<141> 2001-03-20

<150> 08/847,063

<151> 1997-05-01

<160> 53

<170> PatentIn Ver. 2.1

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<212> DNA

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tct gtg cgc atg tcc tgc aaa tcc tca ggg tac att ttc acc gac ttc 96
Ser Val Arg Met Ser Cys Lys Ser Ser Gly Tyr Ile Phe Thr Asp Phe
20 25 30

tac atg aat tgg gtt cgc cag tct cat ggt aag tct cta gac tac atc 144
Tyr Met Asn Trp Val Arg Gln Ser His Gly Lys Ser Leu Asp Tyr Ile
35 40 45

ggg tac att tcc cca tac tct ggg gtt acc ggc tac aac cag aag ttt	192
Gly Tyr Ile Ser Pro Tyr Ser Gly Val Thr Gly Tyr Asn Gln Lys Phe	
50 55 60	
aaa ggt aag gcc acc ctt act gtc gac aaa tct tcc tca act gct tac	240
Lys Gly Lys Ala Thr Leu Thr Val Asp Lys Ser Ser Ser Thr Ala Tyr	
65 70 75 80	
atg gag ctg cgt tct ttg acc tct gag gac tcc gcg gta tac tat tgc	288
Met Glu Leu Arg Ser Leu Thr Ser Glu Asp Ser Ala Val Tyr Tyr Cys	
85 90 95	
gcc ggc tcc tct ggt aac aaa tgg gcc atg gat tat tgg ggt cat ggt	336
Ala Gly Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr Trp Gly His Gly	
100 105 110	
gct agc gtt act gtg agc tct ggt ggc ggt ggc tcg ggc ggt ggt ggg	384
Ala Ser Val Thr Val Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly	
115 120 125	
tcg ggt ggc ggc gga tca gac ata gta ctg acc cag tct cca gct tct	432
Ser Gly Gly Gly Gly Ser Asp Ile Val Leu Thr Gln Ser Pro Ala Ser	
130 135 140	
ttg gct gtg tct cta gga caa agg gcc acg ata tcc tgc cga tcc agc	480
Leu Ala Val Ser Leu Gly Gln Arg Ala Thr Ile Ser Cys Arg Ser Ser	
145 150 155 160	
caa agt ctc gta cat tct aat ggt aat act tat ctg aac tgg tac caa	528
Gln Ser Leu Val His Ser Asn Gly Asn Thr Tyr Leu Asn Trp Tyr Gln	
165 170 175	
cag aaa cca gga cag cca ccc aag ctt ctc atc tat aag gta tcc aac	576
Gln Lys Pro Gly Gln Pro Pro Lys Leu Leu Ile Tyr Lys Val Ser Asn	
180 185 190	
cga ttc tct gga gtc cct gcc agg ttc agt ggc agt ggg tct gag tca	624
Arg Phe Ser Gly Val Pro Ala Arg Phe Ser Gly Ser Gly Ser Glu Ser	
195 200 205	
gac ttc acc ctc acc atc gat cct gtg gag gaa gat gat gct gca ata	672
Asp Phe Thr Leu Thr Ile Asp Pro Val Glu Glu Asp Asp Ala Ala Ile	
210 215 220	
tat tac tgt agc caa act acg cat gtt cca ccc acg ttc ggc tcg ggg	720
Tyr Tyr Cys Ser Gln Thr Thr His Val Pro Pro Thr Phe Gly Ser Gly	
225 230 235 240	

acc aag ctg gag ctg aaa cgt gct agc cag cca gaa ctc gcc ccg gaa 768
 Thr Lys Leu Glu Leu Lys Arg Ala Ser Gln Pro Glu Leu Ala Pro Glu
 245 250 255

gac ccc gag gac 780
 Asp Pro Glu Asp
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<210> 2
 <211> 260
 <212> PRT
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 <223> Description of Artificial Sequence: Synthetic
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Ser Val Arg Met Ser Cys Lys Ser Ser Gly Tyr Ile Phe Thr Asp Phe
 20 25 30

Tyr Met Asn Trp Val Arg Gln Ser His Gly Lys Ser Leu Asp Tyr Ile
 35 40 45

Gly Tyr Ile Ser Pro Tyr Ser Gly Val Thr Gly Tyr Asn Gln Lys Phe
 50 55 60

Lys Gly Lys Ala Thr Leu Thr Val Asp Lys Ser Ser Ser Thr Ala Tyr
 65 70 75 80

Met Glu Leu Arg Ser Leu Thr Ser Glu Asp Ser Ala Val Tyr Tyr Cys
 85 90 95

Ala Gly Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr Trp Gly His Gly
 100 105 110

Ala Ser Val Thr Val Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly
 115 120 125

Ser Gly Gly Gly Gly Ser Asp Ile Val Leu Thr Gln Ser Pro Ala Ser
 130 135 140

Leu Ala Val Ser Leu Gly Gln Arg Ala Thr Ile Ser Cys Arg Ser Ser
 145 150 155 160

Gln Ser Leu Val His Ser Asn Gly Asn Thr Tyr Leu Asn Trp Tyr Gln

	165	170	175
Gln Lys Pro Gly Gln Pro Pro Lys Leu Leu Ile Tyr Lys Val Ser Asn			
	180	185	190
Arg Phe Ser Gly Val Pro Ala Arg Phe Ser Gly Ser Gly Ser Glu Ser			
	195	200	205
Asp Phe Thr Leu Thr Ile Asp Pro Val Glu Glu Asp Asp Ala Ala Ile			
	210	215	220
Tyr Tyr Cys Ser Gln Thr Thr His Val Pro Pro Thr Phe Gly Ser Gly			
225	230	235	240
Thr Lys Leu Glu Leu Lys Arg Ala Ser Gln Pro Glu Leu Ala Pro Glu			
	245	250	255
Asp Pro Glu Asp			
	260		

<210> 3
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 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic
 Primer

<400> 3
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18

<210> 4
 <211> 26
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic
 Primer

<400> 4
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<210> 5
 <211> 32
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Synthetic
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 <210> 6
 <211> 25
 <212> DNA
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 <220>
 <223> Description of Artificial Sequence: Synthetic
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 <210> 7
 <211> 29
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Synthetic
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 <210> 8
 <211> 31
 <212> DNA
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 <223> Description of Artificial Sequence: Synthetic
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<210> 9
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<220>
 <223> Description of Artificial Sequence: Synthetic
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<210> 10
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<220>
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<210> 11
 <211> 30
 <212> DNA
 <213> Artificial Sequence

<220>
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<400> 11
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<210> 12
 <211> 31
 <212> DNA
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<220>

<223> Description of Artificial Sequence: Synthetic
Primer

<400> 12

cttgccaata tatctgcaga aactgccgga a

31

<210> 13

<211> 40

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Primer

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<210> 14

<211> 18

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Primer

<400> 14

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18

<210> 15

<211> 46

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Primer

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46

<210> 16

<211> 63
<212> DNA
<213> Artificial Sequence

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Primer

<400> 16
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<210> 17
<211> 30
<212> DNA
<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Primer

<400> 17
gttaccagag gagccggcgc aatagtatac 30

<210> 18
<211> 36
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<223> Description of Artificial Sequence: Synthetic
Primer

<400> 18
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<210> 19
<211> 36
<212> DNA
<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Primer

<400> 19
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<210> 20
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 Primer

<400> 20
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<210> 21
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 <213> Artificial Sequence

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 Primer

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<210> 22
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 <212> DNA
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 <223> Description of Artificial Sequence: Synthetic
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<210> 23
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<223> Description of Artificial Sequence: Synthetic Peptide

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<210> 24

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic Peptide

<400> 24

Ser Gln Ala Thr His Met Pro Gly Thr
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<210> 25

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 25

Ser Gln Thr Thr His Phe Pro Val Thr
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<210> 26

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 26

Ser Gln Ala Thr His Tyr Pro Thr Thr

<210> 27

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 27

Ser Gln Cys Thr His Trp Pro Val Thr

1

5

<210> 28

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Peptide

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Ser Gln Thr Thr His Val Pro Pro Thr

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<210> 29

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 29

Ser Gln Ala Thr His Tyr Pro Ser Thr

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5

<210> 30

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 30

Ser Gln Ala Thr His Ser Pro Ser Thr

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5

<210> 31

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 31

Ser Gln Val Thr His Gly Pro Arg Thr

1

5

<210> 32

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 32

Ser Gln Gly Thr His Arg Pro Tyr Thr

1

5

<210> 33

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 33

Ser Gln Ile Thr His Val Pro Lys Thr

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<210> 34

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 34

Ser Gln Leu Thr His Leu Pro Arg Thr

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<210> 35

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 35

Ser Gln Pro Thr His Val Pro Pro Thr

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<210> 36

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 36

Ser Gln Val Thr His Lys Pro Gly Thr

1

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<210> 37

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 37
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<210> 38
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 38
Ser Gln Leu Thr His Gly Pro Arg Thr
1 5

<210> 39
<211> 9
<212> PRT
<213> Artificial Sequence

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Peptide

<400> 39
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1 5

<210> 40
<211> 9
<212> PRT
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Peptide

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<210> 41

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<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Peptide

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<210> 42

<211> 10

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Peptide

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<211> 10

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<223> Description of Artificial Sequence: Synthetic
Peptide

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Ser Ser Gly Asn Arg Arg Ala Trp Asp Tyr

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<210> 44
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 <223> Description of Artificial Sequence: Synthetic
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<210> 45
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 Peptide

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<210> 46
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 Peptide

 <400> 46
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<210> 47
 <211> 10
 <212> PRT
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<223> Description of Artificial Sequence: Synthetic Peptide

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Ser Ser Gly Asn Gln Arg Lys Met Asp Tyr
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<210> 48

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic Peptide

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Ser Gln Thr Thr His Val Pro Pro Thr
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<210> 49

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic Peptide

<400> 49

Ser Gln Val Thr His Arg Pro Leu Thr
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<210> 50

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic Peptide

<400> 50

Ser Gln Val Thr His Asp Pro Gly Thr

<210> 51

<211> 9

<212> PRT

<213> Artificial Sequence

<220> .

<223> Description of Artificial Sequence: Synthetic
Peptide

<400> 51

Ser Gln Val Thr His Cys Pro Ser Thr

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<210> 52

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Peptide

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5

<210> 53

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
Peptide

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Ser Gln Val Thr His Tyr Pro Val Thr

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Gly Tyr Ile Ser Pro Tyr Ser Gly Val Thr Gly Tyr Asn Gln Lys Phe	
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aaa ggt aag gcc acc ctt act gtc gac aaa tct tcc tca act gct tac	240
Lys Gly Lys Ala Thr Leu Thr Val Asp Lys Ser Ser Ser Thr Ala Tyr	
65 70 75 80	
atg gag ctg cgt tct ttg acc tct gag gac tcc gcg gta tac tat tgc	288
Met Glu Leu Arg Ser Leu Thr Ser Glu Asp Ser Ala Val Tyr Tyr Cys	
85 90 95	
gcc ggc tcc tct ggt aac aaa tgg gcc atg gat tat tgg ggt cat ggt	336
Ala Gly Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr Trp Gly His Gly	
100 105 110	
gct agc gtt act gtg agc tct ggt ggc ggt ggc tcg ggc ggt ggt ggg	384
Ala Ser Val Thr Val Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly	
115 120 125	
tcg ggt ggc ggc gga tca gac ata gta ctg acc cag tct cca gct tct	432
Ser Gly Gly Gly Gly Ser Asp Ile Val Leu Thr Gln Ser Pro Ala Ser	
130 135 140	
ttg gct gtg tct cta gga caa agg gcc acg ata tcc tgc cga tcc agc	480
Leu Ala Val Ser Leu Gly Gln Arg Ala Thr Ile Ser Cys Arg Ser Ser	
145 150 155 160	
caa agt ctc gta cat tct aat ggt aat act tat ctg aac tgg tac caa	528
Gln Ser Leu Val His Ser Asn Gly Asn Thr Tyr Leu Asn Trp Tyr Gln	
165 170 175	
cag aaa cca gga cag cca ccc aag ctt ctc atc tat aag gta tcc aac	576
Gln Lys Pro Gly Gln Pro Pro Lys Leu Leu Ile Tyr Lys Val Ser Asn	
180 185 190	
cga ttc tct gga gtc cct gcc agg ttc agt ggc agt ggg tct gag tca	624
Arg Phe Ser Gly Val Pro Ala Arg Phe Ser Gly Ser Gly Ser Glu Ser	
195 200 205	
gac ttc acc ctc acc atc gat cct gtg gag gaa gat gat gct gca ata	672
Asp Phe Thr Leu Thr Ile Asp Pro Val Glu Glu Asp Asp Ala Ala Ile	
210 215 220	
tat tac tgt agc caa act acg cat gtt cca ccc acg ttc ggc tcg ggg	720
Tyr Tyr Cys Ser Gln Thr Thr His Val Pro Pro Thr Phe Gly Ser Gly	
225 230 235 240	

acc aag ctg gag ctg aaa cgt gct agc cag cca gaa ctc gcc ccg gaa 768
 Thr Lys Leu Glu Leu Lys Arg Ala Ser Gln Pro Glu Leu Ala Pro Glu
 245 250 255

gac ccc gag gac 780
 Asp Pro Glu Asp
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<210> 2
 <211> 260
 <212> PRT
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 Primer

<400> 2
 Glu Val Gln Leu Gln Gln Ser Gly Pro Glu Leu Val Lys Pro Gly Ala
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Ser Val Arg Met Ser Cys Lys Ser Ser Gly Tyr Ile Phe Thr Asp Phe
 20 25 30

Tyr Met Asn Trp Val Arg Gln Ser His Gly Lys Ser Leu Asp Tyr Ile
 35 40 45

Gly Tyr Ile Ser Pro Tyr Ser Gly Val Thr Gly Tyr Asn Gln Lys Phe
 50 55 60

Lys Gly Lys Ala Thr Leu Thr Val Asp Lys Ser Ser Ser Thr Ala Tyr
 65 70 75 80

Met Glu Leu Arg Ser Leu Thr Ser Glu Asp Ser Ala Val Tyr Tyr Cys
 85 90 95

Ala Gly Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr Trp Gly His Gly
 100 105 110

Ala Ser Val Thr Val Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly
 115 120 125

Ser Gly Gly Gly Gly Ser Asp Ile Val Leu Thr Gln Ser Pro Ala Ser
 130 135 140

Leu Ala Val Ser Leu Gly Gln Arg Ala Thr Ile Ser Cys Arg Ser Ser
 145 150 155 160

Gln Ser Leu Val His Ser Asn Gly Asn Thr Tyr Leu Asn Trp Tyr Gln

	165		170		175
Gln Lys Pro Gly Gln Pro Pro Lys Leu Leu Ile Tyr Lys Val Ser Asn					
	180		185		190
Arg Phe Ser Gly Val Pro Ala Arg Phe Ser Gly Ser Gly Ser Glu Ser					
	195		200		205
Asp Phe Thr Leu Thr Ile Asp Pro Val Glu Glu Asp Asp Ala Ala Ile					
	210		215		220
Tyr Tyr Cys Ser Gln Thr Thr His Val Pro Pro Thr Phe Gly Ser Gly					
	225		230		235
					240
Thr Lys Leu Glu Leu Lys Arg Ala Ser Gln Pro Glu Leu Ala Pro Glu					
	245		250		255
Asp Pro Glu Asp					
	260				

<210> 3
 <211> 18
 <212> DNA
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<220>
 <223> Description of Artificial Sequence: Synthetic
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<400> 3
 tggaccaaca acatcggt

18.

<210> 4
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<220>
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<400> 4
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<210> 8
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<400> 10
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<210> 14
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 <223> Description of Artificial Sequence: Synthetic
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<210> 15
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<220>
 <223> Description of Artificial Sequence: Synthetic
 Primer

<400> 15
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<210> 16

<211> 63
<212> DNA
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<223> Description of Artificial Sequence: Synthetic
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<400> 16
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gct 63

<210> 17
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 17
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<210> 18
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Primer

<400> 18
tacattttca ccgacttcaa tatgaattgg gttcgc 36

<210> 19
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Primer

<400> 19
tacattttca ccgacttctg catgaattgg gttcgc 36

<210> 20
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Ser Gln Thr Thr His Val Pro Pro Thr

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<211> 9

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Ser Gln Ala Thr His Met Pro Gly Thr

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<210> 25

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Ser Gln Thr Thr His Phe Pro Val Thr

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Ser Gln Ala Thr His Tyr Pro Thr Thr

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Ser Gln Cys Thr His Trp Pro Val Thr

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<210> 28

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Ser Gln Thr Thr His Val Pro Pro Thr

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Ser Gln Ala Thr His Tyr Pro Ser Thr

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Ser Gln Ile Thr His Val Pro Lys Thr

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Ser Gln Leu Thr His Leu Pro Arg Thr

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Ser Gln Pro Thr His Val Pro Pro Thr

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Ser Gln Val Thr His Lys Pro Gly Thr

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<210> 37

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<400> 37

Ser Gln Leu Thr His Trp Pro Ser Thr
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Ser Gln Leu Thr His Gly Pro Arg Thr
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Ser Ser Gly Asn Gln Arg Lys Met Asp Tyr

1 5 10

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Ser Gln Thr Thr His Val Pro Pro Thr

1 5

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Ser Gln Val Thr His Arg Pro Leu Thr

1 5

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<400> 50

Ser Gln Val Thr His Asp Pro Gly Thr

1

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<210> 51

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<400> 51

Ser Gln Val Thr His Cys Pro Ser Thr

1

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<210> 52

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<400> 52

Ser Gln Val Thr His Trp Pro Pro Thr

1

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<210> 53

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<400> 53

Ser Gln Val Thr His Tyr Pro Val Thr

1

5